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SCIENTIFIC AMERICAN SUPPLEMENT. No. 1214

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Scientific American, established 1845.
Scientific American Supplement, Vol. XLVII, No. 1214. NEW YORK, APRIL 8, 1899. Scientific American Supplement, $5 a year.
Scientific American and Supplement, $7 a year.

THE PERIAR DAM.

THIS great irrigation work of the government of India has now been in operation about two years, and some of its beneficent results can be seen.

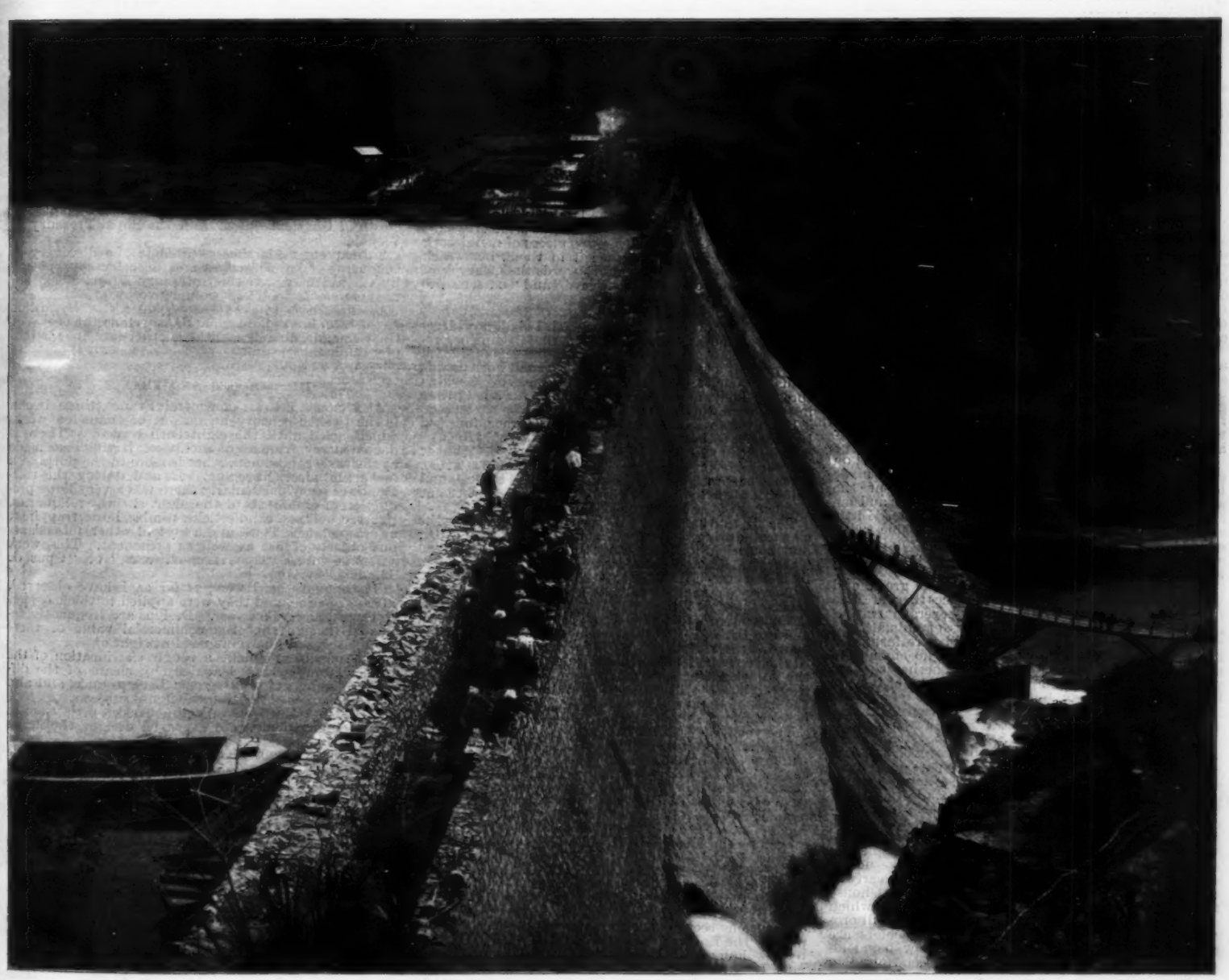
The illustration shows the great dam in the mountainous region of Travancore, and the lake formed by the damming of the Periar River, whereby a steady flow of water is turned back eastward into the arid plains of the Madura district, and irrigation provided for 150,000 acres of land.

As the bed of the river is solid rock, there is no underground foundation, and the dam is actually 178 feet above the lowest water level. Its length at the top is 1,300 feet, its width at the bottom 138 feet and at the top 12 feet, with a parapet 4 feet high and 4 feet thick. It contains 5,000,000 cubic feet of masonry.

The lake caused by throwing back the waters of the river, and the mountainous character of the region round about, may also be seen. The lake area is 14 square miles. Six miles back to the left, as we look at the picture, is the tunnel through which the water is carried into the plains of Madura. The maximum depth of the lake at the dam is 174 feet. The outflow through the tunnel is 1,600 cubic feet per second.

The tunnel is 5,700 feet in length and 12 in breadth by 7½ in height. Leading from the tunnel is about a mile in all of open rock cutting 25 feet wide, from 30 feet depth to nothing.

From this cutting the water is conveyed by the bed of a small stream 46 miles to its junction with the chief river of the Madura district, thence 40 miles further down that river to the distribution works.



PERIAR RIVER DAM IN THE MADURA DISTRICT, INDIA.

The distribution works, as originally planned, include a main channel 38 miles long, twelve branch channels extending 93 miles, and 102 miles of minor distributaries. The main channel is planned to carry in its first reach 1,500 cubic feet per second with a depth of 6 feet, and so on in diminishing quantities until the twelfth reach, where it carries 288 cubic feet per second. One railroad bridge and twelve road bridges cross the main channel, and thirteen road tunnels cross the branch channels. The small distributaries are being continually extended and new ones made, so that the distribution of water is greater than at first planned.

It was hoped that in the tenth year after completion the area irrigated by the works would amount to 101,000 acres. After one year of operation it was found that 63,751 acres had actually been irrigated. Of this only 6,442 acres could be credited to new works, the balance of 57,309 acres being considered to be "old irrigation," i. e., effected from old channels not constructed from government capital.

The old irrigation tanks occupy much space that will gradually be reclaimed for cultivation, for many of them will become unnecessary as the minor distributaries are extended. A still greater blessing brought by these works is the distribution of running water for the stagnant water of the old tanks among hundreds of thousands of people. Many a village that heretofore depended on some stagnant pond for its water supply for drinking, cooking, washing, provision for the cattle and buffaloes, now rejoices in having a running stream of good water. Cholera is thereby diminished, and the general health of the people improved.

The government spent an equivalent of nearly $3,000,000 on the original works, and expects to recoup itself from the increase in revenues, but whether it succeeds or not, this enterprise will always redound to its credit in the inestimable blessings it has brought to this part of its domain.

J. S. CHANDLER.

Madura, South India.

The absence of docking accommodation of any sort in the port of Barcelona has at length led to the decision of the harbor board to accept the tender of Messrs. Clark & Standfield, Westminster, for installing one of their patent depositing docks, the dock to be constructed in Spain. It is to be placed in a sort of basin in the outer port of Barcelona, and the depositing stages will be placed along two sides of this basin, each row having a length of 650 feet. The dock is to be moored in the middle of the basin, and is in two sections, placed back to back, with their pontoons facing the grids. The grids facing the small section will be comparatively light, to receive the smaller classes of vessels; but those opposite to the double section will be of the strongest construction, and capable of receiving vessels up to a dead weight of 6,000 tons. The dock will also be provided with its own hauling engines and gear for traversing the different sections, either together or separately, from their moorings to all parts of the depositing grids, the engine power being sufficient to perform the whole operation of lowering the dock, lifting the vessel, and depositing the same on the grid, within a period of four hours. All minor fittings will be fully provided, and the dock generally may be consider-

ed as being fitted with all modern requirements, and, when completed, will form a most useful addition to the port of Barcelona.

VITREOUS ENAMELS.*

By CYRIL DAVENPORT.

I.—EARLY ENAMELS.

I DO not intend this evening to trouble you much about the technical part of the art of vitreous enameling on metal, but rather to mention a few elementary points only, in order that you may more clearly understand the one or two simple terms I shall use in describing the finished examples, slides of which I have to show you on the screen.

Enameling is, of course, the outcome of the very ancient art of glass-making, and it is likely enough that the discovery that certain kinds of glass will, under particular conditions, adhere to metal, was accidental.

I define an enamel, for my present purpose, as a glass film fused upon, and adherent to, a metal groundwork.

Glass, as we know it, is not one substance alone. (Silica 5, crystal borax 3½, and niter 3¼ make glass easily with a blowpipe.) The main ingredient in all glass is silica, or, as we popularly know it, flint, and with this are mixed various other substances, which render it easier to fuse and softer when fused.

A Japanese receipt for an enamel glass is given by Mr. Bowes as follows:

	Per cent.
Oxide of lead	37·15
Lime	4·92
Magnesia	0·90
Soda	5·19
Silica	51·84
	100·00

This is colorless, but for the purposes of enamel workers such glass would rarely be needed; color becomes a necessity, and it is easily produced by melting the proper kind of glass with the oxides of various metals. There are now many shades of enamel colors procurable, but in olden days they were few and simple, such as—

Red, probably due to oxide of lead with mercury (Watson), or might be oxide of iron (Bowes).

Blue, oxide of cobalt.

Green, oxide of copper.

Different proportions of iron will give gray, yellow, and pink, and black may be iron or copper or manganese. The oxide of tin makes an opaque white, and the oxide of gold, on gold, a rich ruby red. When used with the oxide of tin any of these colors will make opaque enamels; without the tin they are generally translucent in different degrees. On impure metal translucent enamels are always likely to become opaque after the firing.

The most usual metals on which enamels are fused are gold, silver, and copper. Translucent colors will sometimes fuse satisfactorily on all these, but they are only to be relied on when they are on a fine gold ground. The process, roughly speaking, is to grind the enamel to a fine powder in a mortar, and apply it wet to the metal where required; then fuse all together at a red heat, either by blowpipe or furnace.

The earliest enamels existing are now to be found on some of the pieces of exquisite gold jewelry made by the Greeks and by the Etruscans about the sixth century B. C. These enamels are small and accessory to the finest work in gold ever made. Little shallow spaces were outlined by means of a fine twisted gold wire soldered on to the metallic groundwork, and into these "cloisonné" spaces the enamels were fused, most likely by means of a blowpipe.

The colors used are dull blue, dull pale green, and white. Besides these little cloisonné pieces there are also found among the Etruscan jewelry several instances of earrings with small pendent figures of animals and birds in white enamel fused on a gold wire fashioned in a proper form. After these there are no enamels to be found for a considerable time. Whether the art was lost or whether simply the examples of it have been lost I cannot say, but there seems to be no trace left of it until we come to the third century A. D., when a Greek writer, Philostratus, in a work called the "Icones," mentions variegated horse trappings, and writes: "They say that the Barbarians who live in, or by, the sea (Ἐν ὠκεανῷ) pour colors on to heated brass, and they adhere, become as hard as stone, and preserve the designs which are made in them." This undoubtedly refers to vitreous enamels, and moreover it seems very likely that it also refers to Britain, as the dwellers in an island might well be described as "living in the sea," but some authorities think the Gauls are intended. Although we now have no instances of enameled work done in Britain so early as the third century, there are many specimens of house furniture belonging to the late Celtic period which show clearly enough that such objects were in all probability commonly made. On these the colors are simple, dull red, dull blue, and dull yellow being almost always found. Specimens have been found in Yorkshire, Somerset, and Norfolk particularly.

In Ireland were made beautiful cups, shrines, and bell-covers, ornamented with enamels and niello work at a very early date, the Ardagh cup being perhaps one of the finest pieces left; it is supposed to date from the ninth or tenth century.

The Romans brought the art of enameling on bronze with them, and practiced it largely here up to the fifth century (Romans left Britain 436); and after them, what may be called the Anglo-Roman work, nearly resembling the actual Roman, continued for some time, the colors being dull red, dull blue, dull green, and white rarely. These enamels are usually on small objects—fibulæ or brooches, pins of various kinds, studs, and numerous small articles of little artistic merit. Some of them appear to have been made of brass (copper and zinc) and some of bronze (copper and tin, with sometimes phosphorus, manganese, lead, or zinc), and they appear in many cases to have been first cast from a mould, and subsequently finished with a graver, in the champlevé manner, in preparation for the enamel. The bronze pieces often have a beautiful green patina upon them.

* Paper read before the Society of Arts, February 21, 1899.

From the fifth century, until the coming of the Normans, during the Anglo-Saxon period, much beautiful jewelry with cloisonné work was done here, probably by Celtic workmen. At first sight much of this appears to be enameled, but actually it resembles the Egyptian work of like character, the cloisonné spaces being filled with accurately cut pieces of stone, glass, or composition, kept in place either by some strong cement underneath or else by the slight projection of the upper edge of the cloison itself. Generally, if the cloisons inclose deep hollows, this inlaid work may be expected; but if the hollows are shallow, they are more likely to have been enameled.

During the reign of King Alfred, in the ninth century (879–896), it is possible that a much finer kind of enameled work than any that had preceded it in these islands was produced. There are now, I believe, only four specimens of this work left, and they are fine instances. One is at the Ashmolean Museum, at Oxford, and is known as the "King Alfred's jewel;" round the setting is a legend, saying: "Alfred caused me to be made." The other three are in the British Museum, one known as the Dowgate Hill brooch, because it was found there. It bears the crowned portrait of a king, supposed to represent Alfred himself. Another, known as the Hamilton brooch, because it belonged to Sir William Hamilton's collection, has a charming conventional design in the center; and the last bears a female bust, the enamel of which is discolored by time. All these are most skillfully and beautifully worked in the finest cloisonné manner, and many of the colors are translucent. The three brooches in the British Museum are, moreover, set in gold, two of them with pearls. They are pieces of jewelry of which any nation may be proud, and, moreover, they are among the very earliest existing enamels in which any attempt at portraiture has been attempted. Even if the Alfred jewel and the female bust brooch are not meant for any particular person, there seems to me little doubt that the Dowgate Hill brooch is intended to represent an actual king, as it is crowned with a similar crown to those which are shown on coins of about the same time.

All the fine arts received a stimulus under King Alfred. There is a tradition that he sent Bishop Sigelin to India. This expedition brought back stores of treasure, precious stones, and jewelry of various kinds, the study of which is supposed to have encouraged Alfred's goldsmiths, who are said to have worked under his personal supervision, a supposition to some extent supported by the words on the edge of the setting of the Alfred jewel, "Aelfred me heht gewurkan."

I will first show you slides of two pieces of metal work that have no enamel or inlays left in them, but which will make more clear than any words the meaning of the terms "cloisonné," "champlevé," and "bassetaille."

II.—BYZANTINE.

The school of enameling to which I shall now draw your attention is that known as the Byzantine, remembering always that this term must be considered to represent a style, rather than only such work as was actually done at Byzantium, a style, moreover, which spread widely, and had great influence for a long time in the entire world of art.

Byzantium was an ancient city of Thrace, founded by a Greek colony under the leadership [of "*Βυζας*," whence its name, in the seventh century B. C., but it did not arrive at any importance until about 330 A. D., when Constantine the Great made it his capital, and called it after his name, when Constantinople became the center of the Byzantine or Eastern Empire.

The Byzantine school of art developed from the classical during the fourth and fifth centuries A. D., and flourished until the conquest of the empire by the Turks, in 1453, and the more nearly it approximates to its Greek original, the finer it is.

The style spread largely, and its influence strongly survives, even to the present time, in Russia. It is always rich in color, often to an exaggerated extent, and the Byzantine workmen are said to have jealously guarded the secrets of vitreous enameling in metal until the latter half of the eleventh century, after which the knowledge became widely spread, owing partly to the migration of their own workmen and partly to the incoming of foreign workmen, who took the knowledge back with them to their own countries.

The very early Byzantine enamels which still exist are largely figure subjects, and in all probability those which preceded them, if there were any such, were of the same character. It is very likely, owing to this, that nothing now remains to which an earlier date than the tenth century can with any probability be assigned. This is supposed to be about the date of the small pectoral cross or reliquary which formerly belonged to the Beresford Hope collection, and is now in the British Museum. It is very delicately cloisonné, and bears representations of Christ, His Mother, and Saints.

An explanation of the disappearance of the very early Byzantine enamels may be found in the existence of a curious sect or party founded in the Eastern Empire by the Emperor Leo the Isaurian, and continued by his immediate successors, Constantine Copronymus, Leo the Armenian, and Theophilus. This sect was called the "Iconoclasts," and their mission was to destroy all images of any kind wherever they could find them. They lasted until the ninth century. It is very likely that in the churches were many enamels of saints and holy personages, and it is quite possible that the Iconoclasts made practically a clean sweep of them.

There is, fortunately, one magnificent piece of enamel work still existing, which makes it easy to realize that the Iconoclasts may have had full provocation for the destruction of such treasures. This is known as the "Pala d'oro," and is the back of the altar of St. Mark's Cathedral at Venice. It is about 11 feet long by 5 feet in height, and consists of a silver gilt framework, richly worked, and studded with jewels, set, moreover, with enamels of different dates and sizes, portraits, saints, and scenes from biblical history.

The two largest enamels represent our Saviour and the Archangel Michael, and parts of both of these are in relief and jeweled, the relief pieces being added after the enamels were finished. In the lower part are two most interesting figures, one a portrait of the Doge Ordelafo Faliero, and the other the Empress Irene. There are also two panels of silver with engraved inscriptions which seem to have been added about the fourteenth century. These inscriptions tell us that: (1) Under the Doge Ordelafo Faliero, in 1105, the Pala "Nova facta fuit," and that under the Doge Pietro Ziani, in 1209, it was "Renovata." (2) That under the Doge Andrea Dandolo, in 1345, it was restored, "Novatur."

So from its own evidence we gather that it certainly was older than the date of the Doge Ordelafo Faliero, and it further appears from the ancient chronicles of Venice that in the tenth century the Doge Pietro Orseolo (976–977) ordered a "tabula" to be made for St. Mark's which is supposed to be the Pala, but Francesco Sansovino, in his book on Venice, says that it was not actually brought there until the twelfth century.

No doubt the Doge Ordelafo Faliero altered the Pala considerably, and one of the ancient enamels of a Byzantine emperor has been newly lettered with his name in Latin, and in other ways changed, especially as to the crown.

There has been considerable difference of opinion among experts on the question which of the Byzantine emperors this figure originally represented.

Ludwig Pasini thinks it may have been John Comnenus, as the companion figure is that of an Empress Irene, the name of his wife, who was a daughter of King Ladislas, King of Hungary. It is, however, equally likely that it represented the Emperor Alexis Comnenus I., whose second wife was also named Irene. The enamel of the empress still has its original inscription in Greek, and has not been so much altered as the other. It is a figure full of dignity, and, I think, may be considered one of the finest Byzantine enamels existing.

The peculiarities of the royal dress of the Byzantine emperors are admirably shown in these two figures, and it is interesting to note how they are almost in exact correspondence with the figures of an ancient crown which was discovered in 1860, in a field at Nyitra-Tranka, in Hungary. The plates of this crown are seven in number, and are of different sizes, rounded at the top. The largest is enameled with a portrait of the Emperor Constantine X., called Monomachos, the two next largest his wife, the Empress Zoë, and her sister Theodora, the remaining enamels being of two dancers, and allegorical figures of Humility and Truth. The date of it is about the middle of the eleventh century. The emperor died in 1054. These plates doubtless formed part of a crown designed after the Byzantine fashion, the best existing example of which is the crown of Charlemagne, now in the Royal Treasury at Vienna.

Subsequent researches resulted in the discovery of fragments of jeweled edges and miscellaneous pieces, by the aid of which the antiquary Franz Bock has made a restoration of the complete crown.

Besides these, I have to show you a few Byzantine enamels on bookbindings, and, as well as the crown of Charlemagne, already mentioned, there are fine plaques of a similar shape on the very curious crown of Hungary now at Buda-Pesth.

III.—LIMOGES AND FRANCE.

At Limoges, a town of central France, there began in the twelfth century an output of enameled work, which lasted until the eighteenth century. There is documentary evidence of such work having been made at the earlier date, and, what is more to the purpose, a few actual pieces have survived, and during the thirteenth century particularly there was a very large production of ornaments of the altar, shrines, reliquaries, pyxes, crucifixes, candlesticks, tombs, horse trappings, sword pommels, belts, and a host of other miscellaneous objects of use as well as ornament. This work was known as "Opus Lemoviticum," or "Opus de Limogia."

The enamels used were, as far as I have observed, always opaque, and they were applied to thick copper in the champlevé manner. Designs are frequently repeated—a sign that the commercial value of these enamels was at all events not lost sight of.

It is possible to make a rough classification of the earlier Limoges enamels, chiefly by means of the different manners of treating the backgrounds, and also by the manner of treating the figure subjects.

1. In the twelfth century the backgrounds were in gilt metal, with delicate engraved designs, the figure subjects in enamel.

2. In the thirteenth and fourteenth centuries the backgrounds were enameled, generally in dark blue, and the figure subjects were in gilt metal, either engraved or in partial or whole relief.

During the whole of this time some of the enamel colors were allowed to gradate into each other without the interposition of a metal boundary line. The colors which are treated in this way are usually in small bosses, corners, or monumental scrolls; they are arranged in two sets—deep red, dark blue, pale blue, and white, and dark blue, green, and yellow. This merging is not, however, to be considered as an absolute sign of Limoges work, as it also occurs on German enamels of an early date, the blue gradating to white and the greens to yellow.

Toward the end of the fourteenth century a lull came over the large production of enamels from Limoges, possibly to some extent due to overproduction, but also to the growing appreciation of works of art in ivory, the precious metals, and other media; but during the latter half of the fifteenth century a remarkable reaction set in, not that the old champlevé manner of working recovered its lost ground, but a new, freer, and more artistic method came into existence. This is known as the "painted" style, and in it the copper is left plain, the enamels being applied direct upon it. The painted enamels are in two distinct manners, one known as "grisaille" and the other in rich colors.

In the case of the grisaille enamels the surface of the copper is all covered with a very dark enamel, and on this the design is "painted" in white, layer after layer, thick in the high light and thin in the shadows. On these enamels there is here and there a little red for flesh color, and a liberal use of fine gold painted lines and scrolls. One great value of the painted gold lines in enamel work is that, as it alone looks the same before firing as it does after, the artist can accurately judge the effect he is producing. The painted enamels in color are, so to speak, inlaid side by side, or, in some

cases, where special parts are required to be particularly brilliant, shaped pieces of gold or silver foil are applied with translucent enamels over them, the rest of the enamel being finished first. On these colored enamels there is also a free use of painted gold lines and scrolls, often used to mask the lines of junction of the different colors, which are likely to show accidental defects, and to some extent run into each other.

A convenient classification of the painted enamels into three styles was suggested by Sir Wollaston Franks, i. e.:

1. The "Early Style," from 1475 to 1530.
2. The "Fine Style," from 1530 to 1580.
3. The "Minute Style," or the decadence, from 1580 to the close of the manufacture in the eighteenth century.

The peculiarities of these three styles may be briefly described as follows:

1. The "Early Style" (1475–1530) was on thick copper, nearly flat, the whole surface being smoothly covered with a very dark, nearly black, enamel; in this the design, as I have already mentioned, is painted in white enamel, with traces of color and gold lines. Sometimes large pieces of foil under translucent enamels were used in such enamels as were also painted in color, but these paillettes are never used with grisaille work alone.

2. In the "Fine Style" (1530–1580) the copper is much thinner, and there is a marked Italian influence seen in many of the designs. Large pieces of foil under translucent colors were discontinued, but the use of very small pieces of jewel-like form and arrangement called "paillons" came into use. Artists of the family of Penicaud used these "paillons" freely, they also frequently stamped the letters "P. L." on the copper of their enamels—probably standing for "Penicaud Limousin." The paillons are not much more satisfactory than their predecessors the paillettes, as in both cases the translucent enamels have a special tendency to chip off, and otherwise fine enamels are often spoilt by bare patches caused by the disappearance of these accessory pieces, color and foil as well.

To the "Fine" period belongs the greatest enameler whose name is known, "Leonard dit Limousin, Esmalieur peintre, valet de chambre du Roy." His earliest signed work is dated 1532 and his last 1574. His work took many forms, vases, cups, chessboards, dishes, etc., but the most important are the wonderful series of portraits, generally the bust only, of the most notable personages of his time in France, ranging from King Francis I. and his queen downward. The frames of many of these portraits are also often ornamented with small enameled plaques.

There are several other names of note among the Limoges enamelers of this time, among them may be mentioned Pierre Raymond, who usually painted in grisaille with slight color and gold; Jean Courtois, who used "paillons," and produced an especially fine black for his background; and Pierre Courtois, whose figures are beaten out in relief before the enameling is done. Jean Court, dit Le Vigier, worked largely in grisaille with slight flesh color, and is known to have made caskets his especial study.

3. The "Minute Style," or, as it may well be called, the decadence, began about the end of the sixteenth century. It is marked by finical execution, probably due to the discovery of a new medium which would carry the metallic colors—resembling what we now call "oil colors." Susanne Court worked faces in profile, finished freely with fine gold painted lines, and the Limousins (Jean, Léonard, Joseph, and François) all made small works, the designs on which are freely taken from contemporary prints.

After 1620, the Limoges enamels lost ground rapidly, the best work of the period being produced by artists of the family of Landin; these enamels usually have brilliant black background, and in the eighteenth century the manufacture, as an important industry, came to an end.

Limoges was not the only place in France where enameled work was made. From some workshop in Southern France comes the splendid gold cup, now in the British Museum, known as "St. Agnes cup," as it bears the history of that saint upon its sides and lid, in basse-taille with translucent enamels. It is the finest existing specimen of this kind of work, and is supposed to have been made during the fourteenth century.

During the seventeenth and eighteenth centuries the minute style of painted enamels, used probably with an oil medium, developed largely in the direction of watch cases, and exquisite work of this kind was done by several artists of note, in latter times much of it being made at Blois. I regret I have no slides of these to show you; the finest work of this kind I have yet found are by Toutin, Durant, Muisard, Camille André, Bouvier, Molière, Vauquer, Petitot, Bordier, and Zinc, while for quite modern French work that of M. Fernand Thesmar is, perhaps, most to be noted, the skill shown in his work in plique-a-jour being quite wonderful.

IV.—MISCELLANEOUS.

Besides the three large divisions into which I have divided my slides, there are many other schools of enameling to which I can only draw your attention by means of a few single examples.

In Italy and Germany the art is old, but in the rest of my miscellaneous slides you will only see comparatively modern work.

The best Japanese work was done during the last century, and is, I think, unequaled for minute working of cloisonné enamels; for delicacy of workmanship and intricate design they have never been equaled. The modern Japanese work is in all technical ways masterly to the last degree, but the design is usually weak.

English work in enamels has found a worthy champion in our member, Mr. Starkie Gardner, and, as he says, no doubt whatever a careful examination would reveal many treasures of home production which are now credited to foreign workmen. What we know is fine, but more is still to be known. The Garter plates at Windsor range from the fourteenth century onward, and in the same century and during the fifteenth there was a large production of enameled croziers, usually silver gilt, cups, ornaments of tombs, and sword pommels, some of them with translucent enamels. At Oxford and Cambridge and at many other places are preserved several splendid cups, exquisitely wrought in silver as a rule, and with enamel ornaments.

During the last century there were the manufactories at Battersea and Liverpool, from both of which there was a large output of small articles. These are on copper, covered all over with a groundwork, usually white, on which designs are painted in "oil colors," and sometimes printed. The best of these are probably the candlesticks, some of which are graceful enough. The enamels vary considerably in artistic value, but generally they are not particularly good.

There is to-day a revival in England of interest in the beautiful art of enameling. We have been fortunate of late years in having had the opportunity at the Royal Academy, the South Kensington Museum, and elsewhere of examining and appreciating the fine work done in this medium by artists such as Messrs. George Frampton, Hubert Herkomer, Alexander Fisher, and Nelson Dawson, and also a helping hand of great value has been given by the excellent technical school of arts and crafts under the auspices of the London County Council.

It is only of comparatively late years that fine enamels have been made in India, among other places at Lucknow and at Jeypore, the last being remarkable for the fine ruby red (oxide of gold) in a gold groundwork.

At Partabgarh, a peculiar kind of enamel is made. Designs cut out of thin gold are inlaid in a dark green groundwork.

At Damascus and other places in the East an easy and very effective way of producing enamels, apparently laboriously made by means of champlevé work, has been hit upon. The outline of the design is simply repoussé from the back of the copper, and the hollows thus made on the other side are roughly filled with opaque enamels.

In Russia, a considerable quantity of enamel work is done on silver and copper. It is usually cloisonné, but sometimes painted on a thin enamel groundwork, always in opaque colors; most of it is not earlier than the last century. The cloisonnés are variously produced by soldering, casting, or repoussé work.

Charming work in plique-a-jour is done at the present time by I. Tostrup, of Christiania, and by M. Hammer, of Bergen, often in bowls and spoon-handles.

During the last century many small enamels, snuff-boxes, candlesticks, etc., were made at Dresden.

DIRIGIBLE AIR VESSELS.

THE SCIENTIFIC AMERICAN, which, more than any other American periodical, keeps pace with aeronautical progress, contains in its issue of October 29, 1898, a most excellent photographic illustration of a difficult subject, viz., the dirigible balloon of De Santos-Dumont, which last September 20 made a free ascension from the Jardin d'Acclimation. With a large experience in photography, and especially as a balloon photographer, I have never seen a better rendering of the details of these aerial creatures, which seldom submit to satisfactory posing or exhibition as photographs.

The construction of future airships will be aided by close scrutiny of this one, which possesses some good features for imitation as well as qualities to avoid.

One of the best features is the comparatively sharp extremities of the gas spindle at bow and stern, in which respect it excelled the noted airship "La France," constructed in 1885 by Renard and Krebs for the French military balloon corps at Meudon, near Paris, and which attained a speed of about 12½ miles per hour, and succeeded several times in returning to its place of departure.

The De Santos-Dumont vessel, with a diameter of 11 feet 10 inches to a length of 82 feet, or ratio of about 1 to 7, appears slender beside the bulk of "La France," having a diameter of 28½ feet and length of 165 feet, or a ratio of nearly 1 to 5·8.

A better form of gas spindle than either was that of M. Debayeux, which copied the plump, rearward-tapering body of "La France," but with sharper bow and stern. Both of these vessels were stiffened throughout their length by a long framework or boat, about ¾ the length of the gas spindle, and slung below it by adjusted cords. The De Santos-Dumont gas spindle lacks this support, and reveals a settling amidships, or hollowing in the back, the reverse of what is known in shipbuilding as "hogging." The remedy for this may be in a better adjustment, or lessened strain upon the middle of this long gas log, or an increased pull downward at bow and stern. A better and simpler remedy may be applied by increasing the amidship bulk of the gas spindle, giving it increased buoyancy there and more of the appearance of an ordinary weaver's spindle, or a continuous curve from end to end, resulting in a still sharper bow and stern without loss of bulk or speed, for it is a fact that although a small proportional sectional area conduces to increasing high speed, this is of little consequence at the low speed heretofore attained by air ships, caused by more important defects. Many airship projectors discourse confidently about driving gas bags 50 miles per hour, without reference to the power required to do it. Now, it needs only a slight force to move even a spherical balloon slowly in still air, and when the vessel has a sharp bow and stern it is quite easy to attain a moderate speed with moderate power, the sharp bow and stern being equally as important as diminution of sectional area. It is only at higher speeds than those attained that slender forms have any great importance in air vessels, and no gas vessel has yet obtained a speed which made a ratio of more than 1 to 3 or 1 to 4 of much importance. As a matter of fact, the dragging through the air of a blunt or square-faced basket or car, suspended so far below the gas spindle as shown in the De Santos-Dumont airship, is a greater factor of resistance than any other feature about it. Just imagine a catamaran on water, with an out-rigger corresponding to this basket, extending 33 feet sidewise, and tugging backward; or trying to play ringmaster of an aerial circle where the flying horse is hog-backed or has an opposing curvature. But the conditions in the De Santos-Dumont airship are such that the balloon is not tugging the basket, but the basket is towing the balloon, with a leverage on one side, or below, of 33 feet, while this same basket is being blown backward or obstructed by the air blast thrown rearward from a propeller 32 inches in diameter, and having a velocity of 1,200 revolutions per minute. Without drawing upon my own experiments in this line for data, I think any mechanic or boatman, not to mention airship inventors, can see why such arrangements afford results not of the best, but positively unfair to the motive power displayed.

Another feature noted is the reported inability of the gas spindle to retain its gas, and consequently its rigid shape. The "La France" is reported to lose about 4 per cent. of its gas in 24 hours. The De Santos-Dumont airship, built by Lechambra, of Paris, evidently lost a larger percentage of gas. It is stated that M. De Santos-Dumont was "Soon compelled to cease his experiments on account of a defective air pump that supplied the small compensating balloon; the aerostat, losing its rigid form, collapsed."

Now, the office of this inner "balonet" as it is termed, is to receive air, introduced by a pump, to compensate for hydrogen lost, and thus keep the balloon plump. If no hydrogen were lost, it would have no office. There should be no hydrogen lost in such a vessel, at so low an elevation as noted, 650 to 1,300 feet, in the limited time of its flight. It is reported that captive balloons in use by the British army balloon corps, which sustain a greater strain than balloons free in air, have been in use for weeks with little loss. I have reason to know, through much experience with captive balloons and dirigible airships, used day after day, that hydrogen gas can, if really necessary, be retained without loss in a properly made fabric gas bag having this result in view, though French manufacturers admit or insist on the necessary loss of gas through their fabric balloons. The simple fact is that few balloons, except the wonderfully great captive balloon of M. Giffard, possess a sufficient number of superimposed varnish tissues to actually retain hydrogen gas as they might with greater perfection in varnishing.

The character of varnish necessary is of much less consequence than the number of layers for producing impermeability, though it is also of importance that the varnish should be pliable, elastic, and not liable to injury by heat, cold, or time, and not subject to spontaneous combustion, which has destroyed many balloons in a few months. As regards these last features, I have scraps from the making of hydrogen balloons twenty years ago which appear as good as new, while I have hydrogen balloons in perfect order and condition which have been annually in service a dozen seasons.

A natural curiosity exists regarding the fabric of balloons and its cost. The unvarnished silk for balloons is all imported and sold, not by the yard, but by the piece. It varies from 18 to 20 yards in length and may be 18 to 24 inches wide, and is collected from a thousand sources, as it is made by scattered native weavers who gather the wild cocoons from the mulberry forests and weave and sell to factors who collect this miscellaneous crop of silk. It is inevitably a foreign production and will never be manufactured in America, and at present no more is imported because of the sweeping and indiscriminate tariff against silk which is absolutely prohibitive on this class, some "700 per cent." I have been told by importers, though that seems an extravagant story. This silk is or has been sold at $6.50 to $8.50 per piece wholesale in 1,000 yard quantities, which makes it cost from 65 to 85 cents per square yard. Other suitable silks, of lighter, finer grades, not so strong, rate at 60 cents to $1 per yard long and from 27 to 32 inches wide.

The varnishing of the silk repeatedly is a slow and laborious operation by hand brushes. With suitable machinery 1,000 yards or more can be smoothly varnished in an hour or so by one or two persons. A dozen coats are not too many, though half a dozen may do if you don't care to save hydrogen. This varnishing, with waste and time entailed, practically doubles the cost or value of the silk. The expense and the diminished supply of silk, together with the greater care and number of coatings required, has resulted in introducing a fine grade of cotton fabric, especially woven for hydrogen gas balloons, in 100 yard lengths, one meter wide, the nap of which felts down over the woven interstices of the cloth in the varnishing machine, and helps to plug them up, while silk threads, like hard wire cloth, require more layers and heavier varnish to become hydrogenproof. This gasproof fabric can be produced at about half the price of silk. Its gasproof qualities are fully as enduring as silk, but it is never so strong. Being wider, it is more easily converted into any form of vessel, from the ready varnished stock on hand, while otherwise the balloon must be made up first and then varnished several times by hand brushes.

The weight of this finished gasproof fabric, for ordinary balloons carrying one to four persons, is about 6 to 7 ounces per square yard or meter.

For almost all forms of aerial framework, good, straight-grained spruce wood is stiffer and stronger per pound than any metal or tubing. Aluminum and its compounds are inferior to steel, and about its only service in aeronautics is for foundation bases, or substitutes for cast iron in otherwise heavy machinery where strength is less an object than saving of weight, and even here it is doubtful if wood is not better. It is absolute lunacy to think of it as a substitute for elastic fabric or flexible gas vessels. It is porous to hydrogen (like ordinary cloth, a common brick or a sponge) and needs to be repeatedly varnished. If converted into a gas spindle or balloon, its destruction is certain upon its first return to the ground, as it must be thin in order to rise as well as gas fabrics, and, being rigid, its sheets may be shattered by the slightest strain or jar on contact with earth, while the elastic gas bag rebounds, like a rubber ball, without harm. The risk of fracture in the air with an aluminum gas-buoyancy chamber is too frightful to contemplate, and if rightly viewed will extract all the pioneer enterprise from any aerial genius who has conscientious scruples about immediately realizing on his life insurance policy.

Ordinary, well calculated air experiments with suitable gas vessels, securely rigged, I regard as practically safe, and the complete immunity of myself and family and my various assistants, during a score of years, corroborates this. The association of the idea of danger with hydrogen airship experiments is largely due to the parachute fatalities so prevalent of late years. To many persons the word "parachute" is synonymous with safety, as if it were an aerial life preserver, while it is actually the most deceptive agent ever used in the air, and its victims are unnumbered.

Some ten years ago I conducted at my "balloon farm"

at Frankfort, N. Y., an exhaustive series of parachute experiments, lasting several weeks, during which I constructed every variety known or which I could invent. These parachutes, of 15 to 30 feet diameter, I dropped with various weights of sand in bags from a hydrogen balloon anchored by three guy ropes at a fixed height of 1,300 feet.

The percentage of sand bag fatalities was so large that I have ever since discouraged "parachute drops" on humanitarian grounds. On account of the many deaths, New York State subsequently passed an act making parachute exhibitions a misdemeanor, punishable with $250 fine and one year imprisonment (New York town laws, 1892, page 528) in addition to the "death penalty" naturally involved. It happened that the first victim in New York State, after the passage of this act, was a young girl from my own village, killed in a distant county, and who had witnessed my experiments, and was fully acquainted with the danger from parachutes. The most serious influence of the parachute has been to establish a prejudice against aerial sports or experiments, while a very extended use of it has not developed a single valuable feature for aerial navigation.

One valuable feature of the De Santos-Dumont airship remains to be noted—its gasoline motor of 3 to 3½ horse power, weighing 154 pounds with all accessories, including the screw. This weight of about 50 pounds per horse power has been equaled or bettered by American manufacturers who produce in quantities gas or gasoline engines weighing 40 to 50 pounds for single motors of ¾ to 1 horse power, which are doubled or quadrupled on one driving shaft at a considerable saving in proportionate weight.

A number of motors are also known to exist which weigh very much less per horse power, but these are not in the market yet, and the limited demand or expense of construction does not encourage manufacture.

A notable defect in light motors is the great weight of fly wheels. A lately introduced American motor of 1½ horse power weighs 85 pounds, of which the fly-wheel alone weighs 50 pounds, leaving the weight of the actual motor 35 pounds only, or 24 pounds per horse power.

The great need for air navigation seems to be a rotary motor, or one in which the active parts of the engine are in revolution, or a compound engine not requiring weight or momentum to keep its crank shaft in motion.

In response to government inquiries I made in July, 1892, an estimate of details for a proposed warship, some of the chief features of which are given below:

	Pounds.
Weight of gas buoyancy chamber with interior parts	1,000
Weight of netting and attachments	500
" keel boat or car	500
" screw propeller and shafting	200
" 20 horse power motor with fuel	1,000
Weight of extra fixtures and attachments	800
Weight of four passengers at 150 pounds each	600
Weight of ballast (convertible into explosives)	400
Weight of magazine or stock of explosives	4,000
Excess buoyant power at command	1,000
Total weight buoyed by hydrogen	10,000

Personal experience with kindred gas vessels has shown that this may be driven at the speed proposed, 20 miles per hour, without deformity by wind pressure.

It must be noted that "La France" had half this buoyancy and carried a 9 horse power electric motor weighing 216 pounds, while its electric pile weighed 956 pounds, or a total of 1,172 pounds, or 130 pounds per horse power, as against a 20 horse power explosion motor estimated to weigh 1,000 pounds with its fuel; yet "La France" made a speed of 12½ miles per hour then, and my problematical estimate of 50 pounds per horse power, made seven years ago, is commercially commonplace now, and can be readily lessened on demand.

It is not necessary, however, to build air ships of the size estimated in order to demonstrate their qualities. If they will not prove their value with moderate dimensions, they have too little limit for further expansion, and there is no need of spending thousands of dollars where five hundred will suffice for constructing gas vessels of spindle shape capable of supporting a single man and a motor of one or two horse power.

CARL E. MYERS.

Frankfort, N. Y.

THE MOVABLE PLATFORM OF SAINT OUEN.

PERHAPS no one has forgotten the success that was scored at the Exposition of 1889 by the Deauville railway, over which, although it extended only from Rue Constantine to Suffren Avenue, ran thousands of trains which carried millions of passengers during the six months of the fair. Despite the great number of the cars, there were times when the service was inadequate, and crowds of people stood in long lines at the approaches to the wickets. According to the anticipations of the organizers, three times as many entrance fees will be registered in 1900 as were recorded ten years ago, and if there were nothing to be offered to the public but a railway as a means of transportation, it is to be presumed that very great difficulties would have to be encountered.

The idea has therefore occurred to seek some other means of carriage; and since the trips of the Deauville trains, no matter how short the interval between them, were inadequate, it has about been decided to construct a continuous railway that will move constantly, and the length of the trains of which will be that of the line itself. The idea is not a new one, since similar systems were operated at the Chicago and Berlin Expositions; but, as it is a question in the present case of a more important application, the commissary general of the Exposition of 1900 requested the projectors to make an experiment, upon the success of which would depend a definitive concession. To this effect, at a few steps from Paris, on the open land of Saint Ouen, there has been constructed a movable platform of the same type as that which is promised us for 1900, but not of so great a length. The floors are mounted upon a frame 7½ feet above the surface of the ground. We use the plural because there are

FIG. 1.—GENERAL VIEW OF THE THREE FLOORS OF THE MOVABLE PLATFORM.

three floors instead of one—two of these being movable and one stationary. The first of the former has a continuous motion of about two and a half miles an hour—equal to the speed of an ordinary walker. The person who wishes to be carried has merely to walk from the stationary floor onto the moving one in taking a step in the direction in which the latter is moving. He may even aid himself by means of the posts that stand about 20 feet apart. The second floor moves with a speed twice that of the other. It is wider than the latter and constitutes the work properly so called, the first part serving only as an intermedium. One can pass from the slow to the rapid speed floor with the same facility as from the stationary to the moving part. The hundreds of visitors who were present at the experiments had an opportunity of learning with what ease this operation could be performed, and those who were entirely inexperienced did as well as the most expert.

The floor is formed of elements that succeed one another and are assembled by means of circular parts—an arrangement that permits the system to pass all curves up to a radius of 30 feet. These elements support a rail fixed under the floor and forming a part of it. Each rail is connected with the one that succeeds it by a joint with a vertical axis, so that it can follow the same sinuosities as the floor itself. These rails move upon driving wheels spaced about 75 feet apart and revolved by means of electricity. The weight of the platform and passengers is sufficient to effect a perfect adhesion and prevent any sliding. The driving wheels are mounted upon spring frames in such a way that the contact with the rail always occurs with the same pressure. This arrangement also permits of compensating for the want of horizontality that might exist in the rails. The roller always bears in the same manner.

Finally, we may state that the floor is provided with two series of small wheels that move upon two stationary rails having the general form of the road. This experimental railway, which extends in closed circuit for a length of 500 yards, represents, on a small scale, what the one of the Exposition will be. It will not have been without utility, for it has shown that the motion produces quite a loud noise that would have annoyed the passengers. Special arrangements have been made to suppress this inconvenience in the definitive structure.

For the above particulars and the illustrations we are indebted to La Nature.

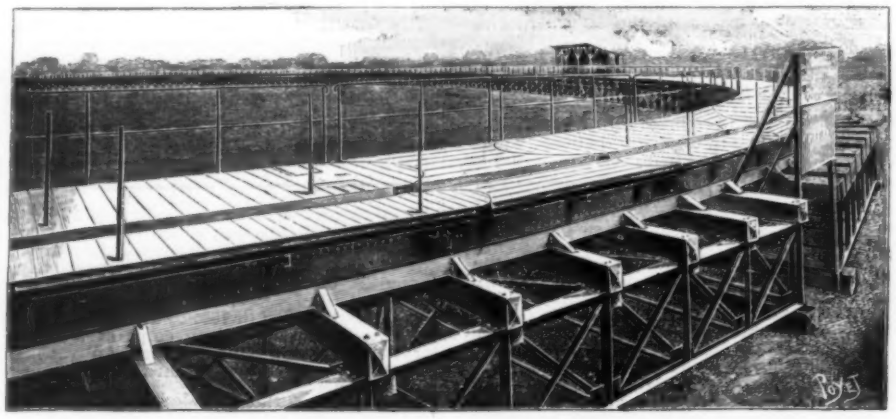


FIG. 2.—DETAILS OF THE FRAME THAT SUPPORTS THE PLATFORM.

Dr. T. W. Burwood (Homeopathic Review) had been in regular attendance on an aged gentleman who exhibited symptoms of heart derangement. The patient was seen in the evening and exhibited no symptoms of collapse; soon after midnight he awoke complaining of difficulty in breathing, and his heart was beating fast and irregularly; his condition became worse, and early in the morning he expired. Dr. Burwood noticed that a terrible gale had arisen about midnight, the barometer dropping from 30·2 to 28·5 before the gale was over, and this coincided with the period of the patient's sudden attack. He points out that the barometer ranges through fully 2 inches, and that when it is very high every square foot of the earth's surface supports about 140 pounds more than when it is low, and he thinks that in the case in question his patient's heart had been beating strenuously for some weeks against all this extra pressure, and when this pressure was suddenly taken off, the heart's action was increased, and it, with the lungs, became oppressed and a clot was gradually formed in the cardiac cavities. The practical application of these observations is manifestly to be found in especial watchfulness of patients of this order with reference to barometric changes.

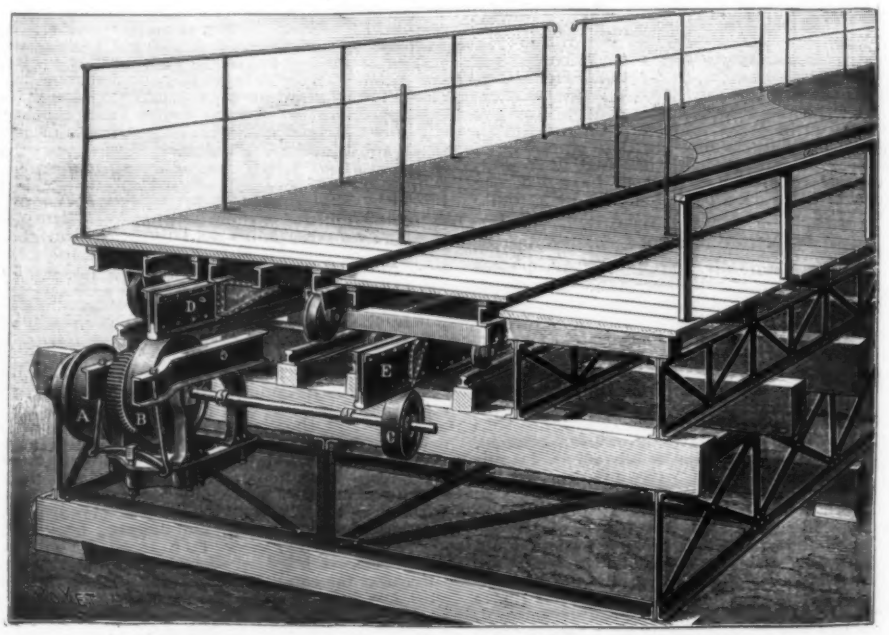


FIG. 3.—DRIVING MECHANISM OF THE PLATFORM.

A, electric motor; *B*, wheel moving under the rail, *D*, and mounted upon a spring frame; *C*, wheel moving under the rail, *E*.

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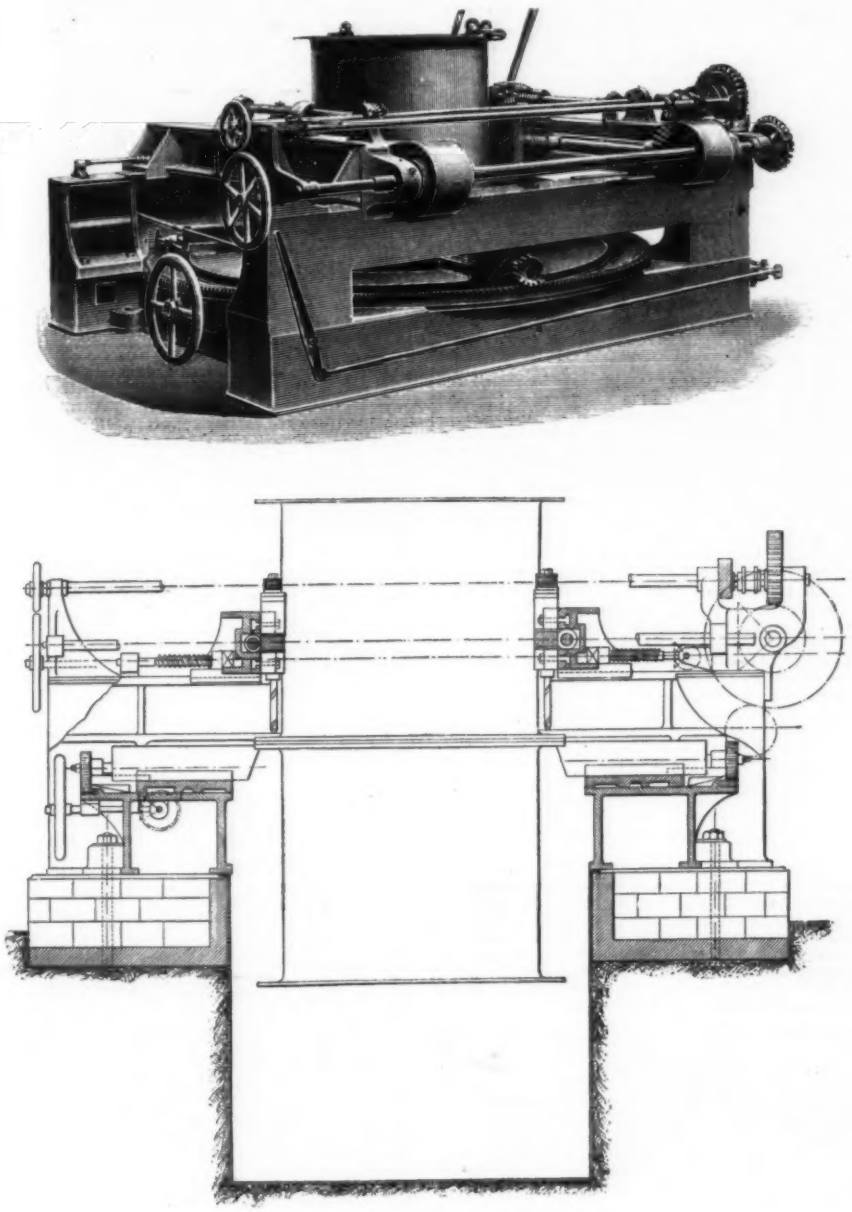
BOILER FLUE DRILLING MACHINE.

THE machine, as shown in the annexed illustration, says Engineering, has been specially designed and provisionally protected by Messrs. Victor Coates & Company, Limited, of Belfast, for drilling the flue joints of Lancashire and Cornish boilers in a vertical position, so as to insure a perfectly true hole through the three thicknesses of plate, namely, the two flanges and the calking ring, which, when together, form what is commonly known as the Adamson's joint. The chief feature of this machine is that when two flue rings and the calking ring are fixed together for drilling, instead of being held at one end by a universal chuck, as is customary with the ordinary machine, they are caught in the center by the turned flanges, the two outer ends being allowed to revolve free. As this is the joint on which the drills are to operate, and this joint is revolved by the pitch gear attached to the universal chuck plate, it can be easily seen that the rivet holes must be naturally truer than by any other arrangement.



BOILER FLUE DRILLING MACHINE.

With a view of carrying out this work with the greatest dispatch, four drills are arranged to operate simultaneously. These are carried by two beams which can be traveled in and out at will, toward and from the center of the machine, for drilling the various diameters of flues, and for placing the rings in the machine, and for removing them. The drills are specially designed to run at a high speed, being fitted with water service, and are so compact that the shortest flue rings can be drilled; they are adjustable by hand for the various pitches. It is worthy of note that the floor space occupied is only 9 feet square, the total height above the ground being only 4 feet.

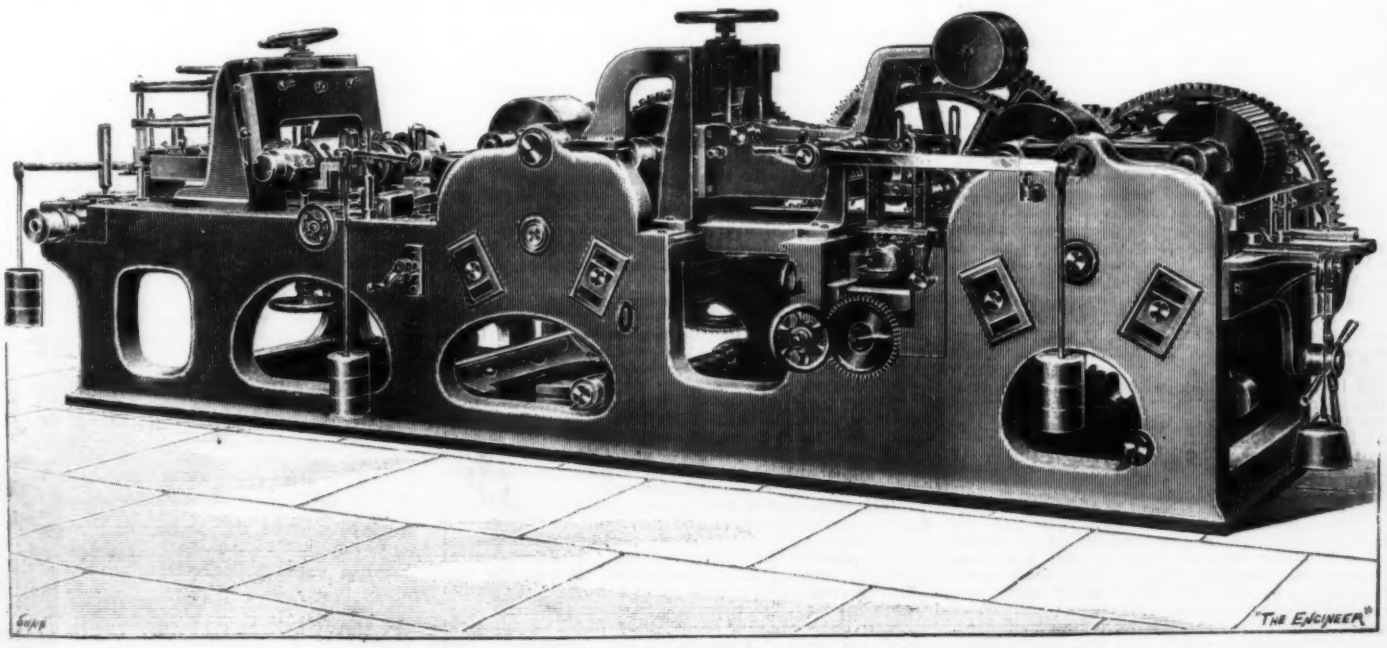
We are informed that, owing to automatic arrangements which are adopted wherever possible, one joint can be drilled per hour. The number of these joints in a Lancashire boiler 30 feet by 8 feet for 120 pounds are, as a rule, about 18; so that the capabilities of this compact little machine can easily be seen.

ROLLER-FEED PLANING MACHINE.

THE accompanying illustration, which is taken from a photograph of a high-speed roller-feed planing machine, for preparing tongued and grooved planed boards for flooring and match-boarding, represents one of the latest developments that Messrs. Thomas Robinson & Son, Limited, of Rochdale, have introduced in their special class of machine tools designed for every variety of wood-working requirements. This machine, says London Engineer, is capable of planing flooring at a maximum rate of feed of 150 feet per minute. The framing is of heavy and powerful construction, and the cutter block spindles and their bearings have been specially designed to enable exceptionally high speeds to be maintained without heating or vibration. All the cutter block spindles are mounted in patent self-lubricating bearings, in which the oil automatically circulates while the spindle revolves. This arrangement insures a constant supply of oil to the bearings and at the same time prevents waste, while avoiding trouble through negligent lubrication.

The feed consists of eight rollers of large diameter, all of which are geared together and driven by powerful spur gearing. The top rollers can all be raised or lowered together by means of a hand wheel at the end of the machine, and the bottom rollers are adjustable in height to allow for wear. The underside of the board is planed first by revolving cutters and finished smooth by fixed knives, the edges of the board being similarly planed, first by revolving cutters, and finished smooth by fixed knives. The top side of the board is also planed, first by means of revolving cutters, and finished to a smooth surface by means of a top plane box with fixed knives, which is attached immediately behind the top revolving cutter block. All the revolving cutter-block spindles are driven at a speed of 5,000 revolutions per minute. The bottom revolving cutter-block can be drawn out of the machine for sharpening or setting the cutters, and it can be raised and lowered for adjusting the depth of the cut. An extra bottom cutter-block is also fitted to the end of the machine for sticking a bead or mould on the face side of the board after it is planed. Machines of this type are extensively used in this country, chiefly in the ports of Hull and Grimsby, for preparing the large quantities of floor boarding which are sent thence to all parts of the kingdom for use in house building. Owing to their powerful construction and capability of dealing with the heaviest class of work, they are also in demand for railway carriage and wagon building, for planing the heavy timbers used in the construction of the framing. One of these machines was recently put down in Grimsby, under conditions of guarantee to turn out planed boards at a rate of feed of 150 feet per minute, and at the trial actually turned out the work at a speed of 175 feet. These machines are made to take in timber of a maximum size of 15 inches wide and 7 inches thick, up to any length, and an idea may be formed of their massive build from the fact that their weight is about twelve tons.

An example of the inefficient postal service in Cuba in former days is related by the commissioners who recently returned from that island. One of the first things they found upon entering the office at Havana to investigate the service was a letter directed to the Director of Posts, whose office was in the next room to that in which it was found. The clerks had not taken the trouble to deliver the letter and it had lain in the office for more than twelve years, having been mailed during President Cleveland's first administration.



HIGH-SPEED ROLLER-FEED PLANING MACHINE.

TRADE SUGGESTIONS FROM UNITED STATES CONSULS.

United States Engines on British Railways.—The following, bearing date of Birmingham, January 27, 1899, has been received from Consul Marshal Halstead:

Alfred Palmer, a civil engineer, writes to The London Daily Mail as follows:

I venture to predict that the introduction upon the Midland Railway of American locomotives will ultimately result in the much-desired central self-coupling buffer and bogie system of rolling stock, as now used throughout the United States and Canada.

American locomotives, by having an elastic wheel base, are safer on the rails at high speeds than ours, being better able to adapt themselves to inequalities of line and surface; but since the material used by and the workmanship of our engineers cannot be excelled, we shall doubtless hear before very long of British firms receiving large orders from America for the "Yankee" type of locomotive.

New Commercial Publication at Brussels.—Consul Roosevelt, of Brussels, writes, November 8, 1898:

The Belgian Minister of Foreign Affairs has recently decided upon the publication, under the management of the commercial museum at Brussels, of a weekly journal devoted to subjects of special interest to merchants and manufacturers. This publication will contain practical information furnished by Belgian consular officers in foreign countries, extracts from special periodicals of other nations, and reports on Belgian and foreign contracts. The publication is expected to render great service to Belgian commerce and industries.

American Locomotives in England.—Consul Smyth writes from Hull, February 18, 1899:

A few months ago the announcement was made in some of the English papers that the Midland Railway Company had closed a large contract for new locomotives with American builders. This news naturally created a great deal of controversy, especially in railroad circles, where it fell like a thunderclap. The British public have been waiting ever since for some explanation on the subject, and that was formally delivered yesterday at the annual meeting of the company in Derby, near Nottingham.

The extract below is taken from a review of the chairman's speech, and appears in all the metropolitan dailies and leading provincial journals this morning. It is regarded, both in public and private quarters, as a striking example of what can be accomplished through the resources of American manufacturers, as well as by the progressive and energetic spirit that brings them into action. The Midland Railway, I may add, is one of the foremost of British systems, and one of the best organized and best equipped in the world. The reasons which prompted the company to place this order in the United States are explained in the clipping, and will be read with a lively sense of interest by all classes of the American people:

"American Locomotives.—It would be seen that the directors had ordered some locomotives in America, and, as this was a new departure, no doubt some information on the subject would be of interest. He would much prefer to order goods of any kind that were of home manufacture, and he might say that the question of cost was not one that entered into the calculations of the directors when asking for tenders from over the water. The increase in their train mileage had been very large lately, being in 1898 considerably over 2,000,000 miles; and it was obvious, therefore, that additional engines must be purchased. For years past, their locomotive superintendent (Mr. Johnson) had impressed upon them that they worked their engines too hard. He believed the ideal position, according to Mr. Johnson, would be that they should have 75 per cent. in steam, but 90 per cent. had been much nearer their figure, so that there was no margin. They had now on order in this country one hundred and seventy engines. They commenced ordering in December, 1897, and the first delivery should have been made in July of 1898, and they should have been receiving a number in each month, which would have made up a delivery to the present time of forty-eight engines. The company had not received one of these. The last order given was in November of last year for twenty engines at an extravagant price, and the makers did not even promise delivery of one for fifteen months, the order to be completed in May, 1900. Locomotives were a necessity to the company; they must have them, and so the directors determined to ask for tenders from America. They asked for tenders for ten engines each from two firms—the Baldwins and Schenectadys—and they received offers to deliver in the one case within ten weeks from the date of the receipt of all necessary information for construction, and in the other case shipment from America was promised for March next. This offer was made in December, so that, while the directors could not get an engine made in England and delivered in Derby in less than a year and a quarter, they could get twenty from America in four months. The engines would be of the American type, with certain alterations which Mr. Johnson considered desirable. They would be of the same power as the Midland engines, and it would certainly be interesting to watch their performance, as Mr. Johnson—and he hoped all his staff—intended that they should have fair play in every particular."

A duplicate clipping was forwarded by Consul Boyle, of Liverpool, under date of February 20. Mr. Boyle adds:

No one item in connection with American imports into Great Britain has attracted so much attention over here as that relating to the recent order by the Midland Railway Company, of England, for twenty American locomotives. Various reasons for the order have been suggested. Although the officials of the railway company have been reticent, it has been generally accepted that the real reason was the inability of English shops to turn out the engines within the time required. Probably, the engineering shops of Great Britain have never been so busy as they are now. There are several reasons for this. First, there are a vast number of domestic and foreign orders which had accumulated during the engineers' strike; then there is the great demand for engine work for steamships, both mercantile marine and navy; and, lastly, there are the orders growing out of the widespread movement in the British municipalities for public improvements—electric lighting, street railroads, waterworks, etc.—which have created an unprecedented demand for machinery and steel and iron structural work.

Here, then, is the opportunity for the surplus products and surplus labor and energy of the United States. In addition, there is the important fact that it has been demonstrated in nearly every line of work in special demand here that the United States can produce cheaper than England; and while but little is said about it, there is a well-founded belief that the American locomotives for the Midland Railway will be delivered here at a considerable reduction as compared with the price of English-made locomotives. At any rate, it can be accepted that the order is an experiment. English mechanics concede that locomotives can possibly be now built cheaper in the United States than in England, but they deny that American engines are as good as English, especial reference being had to durability, and, weight for weight, they claim that the English locomotive is the stronger.

Should the Midland's American locomotives prove a success—that is, cost less money than the English and yet be as strong and serviceable and durable as the English make—it is safe to predict that other orders will follow. The average English locomotive is not as powerful as the average American locomotive. Frequently, two engines are used over here for a load which one American locomotive would haul with ease.

Opening for American Railway Materials in Formosa.—The Formosan government has asked, says Consul James W. Davidson, of Tamsin, for an appropriation of 40,000,000 yen ($20,000,000 in United States gold) for the construction of a railway through the island and for the improvement of Kelung Harbor. The Japanese cabinet has given its approval, and, as the railway and harbor are urgently needed, it is believed the Diet will pass the bill. There is at present in the island a railway 60 miles long, running from Kelung to Teckcham (Hsinchik). It was commenced in 1887 and completed in 1891. It was owned by the Chinese government, but, on the taking over of the island by the Japanese, it passed into the possession of the latter government. The proposed railway will extend south from Teckcham to Takow, a distance of 175 miles.

The Japanese have rebuilt a part of the existing road, but no new rolling stock, with the exception of two or three second-hand locomotives from Japan, has been added. At present, 6 locomotives, 12 passenger cars, and 20 freights and flats are in use. The gage of the present line is 3 feet 6 inches, and the same will probably be continued in the new road. There will be required steel rails (probably of 60 pounds), locomotives, and bridge material for the line, and one of the leading engineers connected with the work has expressed to me his intention of recommending American locomotives.

I have been urgently requested by Mr. H. Yamashita, Taipeh, Formosa, one of the leading merchants and president of the Taipeh municipality, to place his name before the manufacturers of railway supplies; he specially desires information regarding American locomotives. If any of our manufacturers communicate with him, I would recommend that they give full particulars and lowest terms in the first letter, as there is but little time to lose.

American Cycles Abroad.—Bicycles are spreading their sway over the face of the civilized globe, and wherever they are found the trademark of some American firm is seen. Recently the Bureau of Foreign Commerce of the State Department, in response to a request from persons interested in the wheel trade, has been collecting consular reports upon the use of the bicycle abroad, and several of these reports have been published. They show that American-made wheels are popular, and in some places are more in demand than any other makes.

In France, the Department of Paris is the most given to wheeling, with the Gironde second and the Marne third. Consul Prickett, writing from Rheims, says that the wheels in use in the Department of the Marne come mainly from England and this country, and that lately the American makes have gained so largely on their rivals that now there are three American machines sold to every one of British manufacture. The roads in this department, though hilly, are good and kept in first-class repair, as a consequence of which wheeling is increasing. Mr. Prickett advises that the bicycles shipped via Havre, which is the best line of transportation, be packed in extra strong cases to withstand rough weather and handling.

In the Department of La Rochelle the country is flat, and even the small byways are kept in excellent condition, this part of France being noted for its fine roads. It is described as an ideal wheeling country in all respects, and the sport is rapidly gaining there. There is but one cycle factory in the department, and the demand is mostly filled by importation. Of the imported makes, there are five American kinds to two English. A French chainless wheel has had some success here. The duty on bicycles or accessories imported into France is $48.25 per 100 kilogrammes net.

From Sweden, Consul Bergh, at Gothenburg, reports that the introduction of wheels at reasonable prices has spread the use of the bicycle as a method of local transportation among all classes, whereas until quite recently the cycle was regarded as a luxury to be afforded only by the wealthier people. In the cities many workmen own bicycles and go to and from their work on them. The roads are only fair, being very muddy in the fall and spring through the country districts. There is also a great deal of hilly country. Bicycles for use there should be strongly built and provided with mud guards and brakes. There are sixteen factories in Sweden. Importations are mainly from England, this country, and Germany, but the other two countries have gained on America for reasons which Mr. Bergh explains as follows:

"The shipment of inferior bicycles from the United States seems to have created a demand for the English and German bicycles. To my personal knowledge a dealer imported 350 bicycles from America; terms of payment, cash against documents. When the machines arrived it was found upon examination that the inside tube of the tires was so poor that the least pulling or stretching would tear it. The importer called on me, but I suggested that he leave the case with the regular custom house arbitrators appointed for such cases. The bicycles were later sold at auction at a great loss to the importer, who was at the mercy of the exporter, the money being already paid. Cases of this kind do great harm to the reliable American manufacturer who turns out a first-class bicycle."

Two standard makes of American wheels are sold in Sweden, and are well liked there. Though Mr. Bergh speaks of the reduction in price of wheels in general throughout Sweden, the prices which he quotes would not appear cheap here in view of the universal cut in prices this year. The retail prices range from $93.80 to $53.60, and some he writes, "are even sold as low as $42.88 apiece." The duty on finished bicycles is $6.70 apiece; on parts, 53.6 cents a kilogramme.

In Switzerland the American wheels are in great demand, and there is hardly a prominent dealer who does not carry a line of one or more of our standard makes. Germany, however, leads us slightly, particularly in the cheaper varieties. Nine American makes are extensively handled in Switzerland, and the largest firm in Zurich carries five of these and is pushing them to the exclusion of other wheels. Consul Lieberknecht writes of the roads:

"Bicycles are in general use, especially in French Switzerland, Geneva, Lausanne, Zurich, Luzerne, etc. The condition of the roads varies very much; they are not suitable for riding from December until March, owing to the heavy traffic everywhere and to the fact that they are repaved during this period. During the season (which of late has not set in before April) the best roads are found in French Switzerland, Italian Switzerland, and in the cantons of Aarau, Luzerne, and Basel. They are rather rough in the cantons of Zurich, Graubünden and Schaffhausen, where the roads are often cut up by heavy traffic. Half of the roads are hilly, and the cycles have to stand a great strain. The only wheels suitable for this country are those with strong rims; thick, non-slipping tires; reliable brakes, spring saddles, and mud guards. This outfit should be made imperative for every wheel imported into this country. In French Switzerland 1¼-inch tires on 28-inch wheels are asked for most, while in German Switzerland only 1⅝ and 1¾ tires find buyers. The receiving port for French Switzerland is Havre, and for German Switzerland, Antwerp. The duty on bicycles entering this country is 70 francs per 100 kilogrammes ($13.51 per 220 pounds). In French Switzerland 20 per cent. allowance is made for crating and packing, but in German Switzerland the duty is charged on the gross weight. Consequently the crating must be as light as possible, and closed boxes should never be used. It has frequently occurred that more duty had to be paid on the box, owing to its weight, than on the bicycle itself."

Aden is not a wheelmen's paradise. Only the European and American residents indulge in the sport, and they are regarded with some suspicion by the natives, who incline to smell out some witchcraft in the fact of a man spinning along at a rapid rate on two wheels and successfully maintaining his balance. There is one road five miles long, which offers fair conditions to the cyclist; the rest of the roads are not such as to tempt any but the most ardent devotee of the sport. If a man's wheel breaks down, he must repair it himself, as there is not a repair shop in the district. What wheels there are, are imported from this country and England, the greater number being from America. Among the other disadvantages to the sport the consul at Aden mentions the monsoon, which attends to its business of whipping up and distributing the dust pretty steadily during three-fourths of the year. There are no domestic manufacturers in the district and no regular dealers, but firms dealing in other goods have imported some wheels, three standard American wheels being part of their stock in trade. There is no duty.

Madagascar has also been heard from. Consul Gibbs has been able to give exact figures as regards the use of the wheel in Tamatave, the principal receiving port on the east coast. There are two wheels there owned by Frenchmen. As the roads are commonly ankle deep in sand of a particularly obstructive kind, the two enthusiasts have a hard time, but they go abroad enough to be one of the stock wonders of the place to the natives. The roads at the capital, Tananarivo, are in better condition, and there are several wheels of French make there, which come in duty free. There is a tax of $47.25 per 100 kilogrammes on foreign wheels and an additional municipal tax of one per cent. of the cost. Mr. Gibbs speaks a word of warning to prospective importers: "Goods should be packed and invoices prepared with great care. The slightest mistakes are fraught with serious consequences. The invoices should state the weight of all parts of the wheel and the total weight, as well as that of the case and material used for packing."

The Straits Settlements afford a good market for wheels. The roads are admirably suited to wheeling, being level and in fair condition. Though bicycles are in general use among the foreigners there and are even being taken up by the more well-to-do natives, there is no factory in the Settlements. The importations are from Great Britain and this country, and a few from Germany. There is no duty. Seven American makes are on the market. Consul-General Pratt advises that all wheels sent there oe packed in cases lined with pitch paper with vaseline well coated over the plated parts.

United States Milling Machinery in Canada.—Under date of February 20, 1899, Consul Twitchell, of Kingston, writes:

During two months of last season, the Frontenac Milling Company had two expert millers inspecting flour and corn mills, with instructions to find the best in existence without regard to cost. A complete set of milling machinery manufactured in the United States was selected, and is now being put in position in Kingston. The capacity of the mill is 300 barrels of flour and 500 barrels of corn meal per day. If the machinery works well, I can see no reason why American apparatus should not displace the milling machinery now in use in Canada.

United States Books in Honduras.—Consul Johnston writes from Utilla, February 1, 1899, that he has ' suaded the school board on the island to adopt An can school books. The English language, and Spanish, is taught in the schools, and heretofore books used were published in England.

MISCELLANEOUS NOTES.

Up to September, 1898, it was estimated that there were 3,000,000 bicycle riders in the United States. It is estimated that there will be this year 850,000 more. The export of bicycles and parts amounted to $7,000,000. The sum of $200,000,000 is invested in bicycle manufactures. There are 90,000 people employed in this business. The number of reputable bicycle manufacturers in the United States is only 150.

The lumber and pulp industries of New York in the past year consumed 450,995,416 feet B. M. of timber in northern New York. This means the practical stripping of 105,000 acres of forest land of all of its merchantable timber. No provision is made for future growth, and the State Superintendent of Forests, William F. Fox, in his report, points out the danger of longer leaving these forests under private control.

The report of the British consul-general at Meshed, Persia, says that the turquoise mines near Nishapur in Khorassan are at present held by the Malik-ut-Tujjar (head of the merchants) of Khorassan at a yearly rental of 24,000 tumans (about $24,000). There is great uncertainty about the continuity of the contracts, which naturally prevents any good work or improvements in the mines. The production can only be estimated in a very vague way, as there are no records whatever.

The largest frozen meat factory in the world is at Barracas, a suburb of Buenos Ayres, and belongs to the Sansinena family. The establishment is capable of an output of 3,500 sheep per diem, or 100,000 mutton carcasses per month. The freezing rooms have a capacity of nearly 100,000 cubic feet, and have hanging room for 6,000 sheep. The store rooms in which the sheep are stowed after freezing to await shipment have a capacity of 150,000 cubic feet, and can contain upward of 50,000 sheep.

It is likely that most persons suppose an umbrella is manufactured in all its parts in a single factory. There was a time, long ago, when manufacturers made their own umbrella ribs and sticks, just as carpenters once made their own doors and sashes, instead of buying them from a factory, where they are turned out by machinery. Even as late as the eighties, in one factory in New York everything was done on the premises, except the manufacture of ribs and rods. Silk was taken from the bolt, the stick from the log, and the silver for mounting from the ingot. Under these conditions, to see what could be done, an umbrella was once completely made in four hours. Now, however, the work is widely divided. One manufacturer makes ribs, another rods, others caps, ferrules, and runners, while still others supply sticks and handles. The regular umbrella manufacturer simply puts these materials together with the silk or other covering.

The daring men who daily swarm over the new skyscrapers that are going up all over town are not without their measures of precaution. The iron workers themselves, as a class, are men who will indulge in a social glass whenever they feel like it, but they take good care never to go on the job when under the influence of liquor. However, no matter what they do themselves in their hours off, they will not permit the employment of anyone in the capacity of scaffold builder or derrick man who is known to take a drink either off or on duty. The iron workers themselves insist upon this, and they simply do it as a precaution of safety to themselves. If any one of them sees or hears of a derrick or scaffold man taking a drink, it is his duty to report at once, and the man is watched. When proof is found, the offender is instantly discharged. The contractor might protest against such extreme action, but he has the alternative of either abiding by the rule or procuring a new gang of iron workers.—Philadelphia Record.

In the current number of the Berichte, Prof. W. Hempel describes a series of comparative experiments undertaken by him to decide on the most suitable substance for isolating a freezing mixture. Starting with a temperature of about —75° to —80° Cent., produced by solid carbon dioxide and ether, the rate of rise of temperature with time was measured, and as a result, eiderdown was found to be the best insulator, wool carefully dried at 100° Cent. being nearly as good, and having the advantage of cheapness. Three samples of vacuum tubes, of the pattern invented by Prof. Dewar, were also tried, and were found to give very varying results among themselves, and all being much inferior in insulating power to either eiderdown or cotton wool. Thus with eiderdown a rise of 12° Cent. occurred in 88 minutes, with dry wool a rise of 20° to 24° Cent. in the same time, while the three vacuum jacketed tubes gave under the same conditions rises of 65°, 69°, and 39° respectively. The results, says Nature, would seem to show that trustworthy Dewar tubes cannot be bought commercially.

The Italian observers Grassi, Bastianelli, and Bignami, who are associated in carrying out a series of investigations at the hospital of Santo Spirito, Rome, with the object of throwing light upon the etiology of malarial fever, have again met with success in their inoculation experiments with mosquitoes. On this occasion only one species of these insects was employed in the experiment, namely, Anopheles claviger, captured, as before, in the adult stage in the malarious region about Maccarese. The subject of the experiment was a young man who had never suffered from malarial fever and who was received into the hospital of Santo Spirito for hysteria about four years ago, during which time he has been constantly under observation and has had no kind of fever whatever. This man for nineteen days slept in a room in which were set at liberty from time to time numerous specimens of Anopheles claviger. On December 2 (the eighteenth day) he began to feel unwell, and on the 3d the blood, on examination, was found to contain the parasites of malarial fever exclusively of the common tertian type (the spring tertian of Italian writers). This form of fever is prevalent at Maccarese. Considerable difficulty is experienced in continuing these experiments on account of many of the mosquitoes dying and others refusing to feed. This is probably due to the lateness of the season.

ELECTRICAL NOTES.

The Naval Board of Bureau Chiefs of the United States is divided in its opinion as to the value of electric motors for auxiliary power upon warships. In the discussion upon the power to be used for the boat cranes, winches and some other auxiliaries for the five new battleships now being planned, the Naval Board was unable to agree, and the decision was left to the Assistant Secretary of the Navy Department, who decided in favor of steam.

The Electric Boat Company, with authorized capital of $10,000,000, was incorporated in New Jersey recently "to construct boats and other means of navigation and to operate steamship lines." It is stated that the new company will devote especial attention to submarine boats, and that it has undertaken immediately to resume the prosecution of the work on the "Plunger," which has been suspended at the Columbian Iron Works for nearly a year.

Herr Bredig has discovered that when an electric arc is established under water between metallic electrodes such as zinc, lead, platinum, gold or silver, these metals are reduced to an extremely fine powder, which remains in suspension a long time, passing through most filters and giving distinct tints to the liquid. Platinum does not settle for weeks. He explains the phenomenon by saying that the metallic vapors of the arc, condensing instantly in the cold water in the form of a sort of metallic fog, give rise to it.

The mill of the Cliff Paper Company, of Niagara Falls, has for some time past been driven by electric power. It is found, says The Electrical World, of New York, that electric transmission gives an elasticity and comparative smoothness of working sufficiently superior to mechanical connection between the paper-making machines and the driving turbines to make electric transmission advisable even for the shortest distance. In other words, the electric circuit acts as an elastic coupling and thus screens the paper machinery from irregularities of driving.

From an available head of 1,325 feet in a waterfall on the Kaweah River, about 29 miles east of Visalia, Cal., it is proposed to obtain about 1,800 electrical horse power, and transmit this over a distance of 40 miles to a number of towns in the neighborhood. The transmission will be by means of overhead lines worked at 17,300 volts at the station end; but ultimately, when the load is increased, the voltage will be raised to 34,600 volts. The power will be utilized chiefly for pumping purposes in connection with irrigation, and special tangential impulse wheels have been devised for the hydraulic installation, which is under an exceptionally high head. The conveyance of the water from the river to the penstock will necessitate six miles of open flume and a short rock tunnel.

Lord Charles Beresford, who by the way is an expert telegrapher, and who stated a few days ago after riding in a horseless carriage to the navy yard at Brooklyn that he would never ride in any vehicle other than an electric automobile if he could help it, at a dinner given in his honor by the New York Chamber of Commerce referred in his address to the excellent field China offered for the introduction of electrical apparatus, and spoke in the highest terms of the quality of the electrical machinery manufactured in this country. In speaking of Japan, among other things he stated that at Osaka he saw an electrical plant, made and installed by a firm in the United States, that was the finest thing of the kind he had ever seen, and which, besides furnishing current for operating a street railway and pumping water, supplied power for sixty-one different industries.

Col. Kimball, of the Quartermaster's Department in the Army building, New York city, has received orders from the War Department to secure at once an iron ship of from 1,000 to 1,200 tons burden, to lay cables to connect the islands of the Philippines. The department has already ordered for this purpose 166 miles of marine cable, weighing 525 tons. This cable will take about 6,500 cubic feet for coiling. The cable is to be coiled in skeleton tanks in different holds on the vessel. The cable ship must accommodate on the forward deck the "giving-out" machinery, which will weigh from fifteen to twenty tons, and the accessories, weighing from five to ten tons. In the after hold will be fitted out the quarters for the crew of twenty men. This space will be used for coal on the way out. The ship will be kept on station as a cable ship, or can, if necessary, be used as a transport.

"As the microscope brings into sight things invisible to the unaided eye, so the telephone is now bringing to the ear things hitherto inaudible," says Industries and Iron. "This has recently been made possible by Mr. G. C. Whipple, of the Brooklyn Water Works, who has invented an electrical instrument by which the various ranges of temperature may be heard in an ordinary telephone receiver. The apparatus, in external appearance, is like an ordinary electric battery box. From one side of the box extends a long insulated wire, carrying a small coil of bare wire on the end of it. From the other side of the box extend wires which hold a telephone receiver. The latter is to be held to the ear so that the temperature into which the bare coil is thrust may be heard. Heat or cold acting on the bare coil of wire causes an electric current to set up a buzzing in the telephone. When the instrument is used the telephone is held to the ear, while the listener looks at a dial on the battery box marked with figures representing degrees of temperature above and below zero. There is a pointer pivoted in the middle of the dial face. The observer proceeds to turn the pointer from figure to figure on the dial. When the telephone is placed first to the ear, a loud buzzing sound is heard. This is because the pointer does not happen to be at the figure representing the temperature of the water in which the bare coil is placed. As the pointer nears the figure that indicates the correct temperature, the buzzing sound in telephone becomes fainter until, when it comes opposite it, it stops altogether. As soon as the buzzing stops, the observer knows that the temperature of the water has been found. The instrument is now being used in cold storage warehouses to ascertain the temperature of the various rooms without opening them."

SELECTED FORMULÆ.

To Remove Freshly Spilled Ink from Carpets.—First, take up as much as possible of the ink, with a teaspoon, if in considerable quantity, with a blotting-pad, if not so plentiful, using the latter under either condition at the finish. Now pour cold sweet milk over the spot, and, after letting remain a moment, take up as before, repeating the process until the milk comes away only slightly stained with black. Finish by using cold water, into which some lemon juice has been strained. Finally, rinse with pure water, and dry off with a soft cloth, rubbing the surface slightly as the water is absorbed. Old ink spots may be removed by moistening a crystal of citric acid and rubbing the spot gently, repeating the operation until the spot vanishes. —Nat. Dr.

Liquid Polish for Metals.—The following we know, says the National Druggist, from personal experience to yield a first-class product, second to none:

Peroxide of iron (jeweler's rouge)	20 parts.
Rotten stone	20 "
Infusorial earth	20 "
Oxalic acid	1 "
Palm oil sufficient.	
Vaseline sufficient.	
Oil of mirbane sufficient to perfume.	

Pulverize and mix, so proportioning the palm oil and vaseline that you have a liquid sufficiently "thick" to hold the powders in suspension. We would remind you that the preparation of polishes, simple as it seems, is an art, and, like every other, requires a certain amount of practical experience, as well as a knowledge of the materials entering into the composition of the polishing mixture used, and of their preparation for use. To attain a high and uniform grade of polish the materials must be reduced to a very fine and uniform powder. One single grain of the material larger or sharper than the rest will produce scratches that interfere with the finish given the metal. To make sure of your jeweler's rouge being free from dust and grit, prepare it fresh, as follows: Make a solution of iron sulphate (copperas), and another of oxalic acid. Add the latter to the former, as long as it throws down a precipitate. Filter off the liquid, and wash the residue on the filter with repeated charges of water, and dry. When dry, place in a suitable container, and heat gently. It soon ignites and burns until only an impalpable powder is left. This is the polishing material. The infusorial earth must be freed from sand, grit, etc., and reduced by grinding to a condition similar to that of the iron peroxide. The rotten stone and acid must also be powdered. If care and attention be given to these details, you can scarcely fail to get good results.

Red Paint Used on Magnets.—The "paint" used on magnets is usually a non-conducting shellac varnish, carrying cinnabar. Try the following formula:

Cinnabar, pulverized	3 parts.
Venice turpentine	2 "
Shellac, pale	1 "
Alcohol, 95 per cent., sufficient.	

Melt turpentine and shellac, remove from fire, let cool down to about 140° F., and add 10 parts of the alcohol. Rub up the cinnabar with sufficient alcohol to make a paste, and add it to the melted mixture. Put on a water bath for a few minutes, and stir continuously, until a smooth, homogeneous fluid is obtained. Remove from fire, and stir until cold. Preserve in well-stoppered vials, and when desired for use return to the water bath, and heat until the liquid can be applied with a brush. The magnet should be warmed before applying.

Varnish for Gilded Surfaces.—For gilt picture frames, mouldings, etc., the following is recommended:

Gum gutta	40 parts.
Dragon's blood	5 "
Alcoholic extract of sandalwood	5 "
Blond shellac	75 "
Sandarac	75 "
Larch turpentine	25 "
Alcohol, 90 per cent	900 "

Mix and dissolve by the aid of a gentle heat. This varnish is not of great brilliancy of surface, but its transparency preserves the natural appearance of the gold. For gilt surfaces that have become tarnished, or which are covered with pinchbeck, or imitation gold, the following is said to be better:

Gum gutta	30 parts.
Alcoholic extract of sandalwood	3 "
Blond shellac	200 "
Sandarac	50 "
Larch turpentine	25 "
Alcohol, 95 per cent	800 "

Mix and dissolve as before.—National Druggist.

Perfume for the Breath.—

1. Licorice extract (powdered) 2 ounces.
   Oil of cloves 1 drachm.
   Oil of cinnamon 10 drops.

Rub the oils thoroughly with the extract, and then form into a stiff mass. Make this into either small pellets or sticks. When the pill form is adopted, it is common to coat with silver leaf.

2. Oil peppermint (opt.) 3 drops.
   Oil lemon 2 "
   Oil neroli 2 "
   Oil cinnamon 2 "
   Cloves 4 grains.
   Cardamom 8 "
   Vanilla 12 "
   Orris root 15 "
   Mace 40 "
   Sugar 30 "
   Licorice extract 56 "
   Mucilage of gum arabic q. s.

A mixture of oils of peppermint and spearmint with a little oil of cloves would, we think, make a good perfume for the purpose.—Druggists' Circular.

Dog Soap.—

Petroleum	5 grammes.
Wax	4 "
Alcohol	5 c. c.
Good laundry soap	15 grammes.

Heat the petroleum, wax, and alcohol in a water bath until they are well mixed, and dissolve in the mixture the soap cut in fine shavings. This may be used on man or beast for driving away vermin.